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Fig. 9. *Pterygotus bilobus*.

Fig. 10. Terminal tail joint of *Pterygotus acuminatus*.

Fig. 11. The smaller one is *Limulus* just hatched, natural size, mere outline; the larger is the same undergoing the first moult, and leaving the old shell, and having a tail.

Fig. 12. *Limulus Polyphemus*, one year old. The markings on the posterior carapace become less distinct with adult age. The adult female will attain a size even exceeding twelve inches across the cephalic shield.

Fig. 13. *Eurypterus remipes*; size very much reduced.

Fig. 14. *Sao hirsutus*, a trilobite.



## THE SEA-WEEDS AT HOME AND ABROAD.

BY JOHN L. RUSSELL.



THE vegetable productions of the ocean, like those of the drier portions of the earth, are subject to a similar order of distribution. The most common collector of plants becomes soon aware that there are kinds which are not to be looked for in ordinary places, and soon learns to set a value on those which rarely occur to him. He also desires to extend the area of his observations so as to embrace different latitudes, or to obtain the same results by ascending lofty mountain heights. So the collector of sea-weeds does not confine himself to particular districts, but endeavors, either by personal inspection or else through the labor and courtesy of others, to ascertain what forms, seemingly familiar or entirely diverse, may grow abroad. The deeper soundings of the ocean-beds, like the higher elevations of the land, afford him a greater variety, affected by different causes, which in their natural course produce different results.

The general plan of vegetable life, especially in the lower plants, seems to point to constant modification of some one typical form, and this modification appears to have its origin in climatic influences. It becomes a most fascinating study to endeavor to join the separate and divided links so as to

possess, in a series of specimens, the probable method of development which nature has thus instituted. Let me endeavor to adapt this idea to the thoughts of this present essay, and arrange to some extent the sea-weeds (*Algæ*) of our own and of foreign or distant coasts together. Let us see in what kinds there are corresponding ones; and when we select some choice specimen from the beach-drift, or pluck it from the rocks, endeavor to tell on what distant strand it is obedient to the pulsing waves, or perchance attracts other eyes.

The coast of New England presents as great a diversity in outline and in character as perhaps can be found in the same length of the Atlantic shore. We have here the deep inlets like Norwegian fiords in Maine; the bold rocky promontories of Massachusetts varied with the almost level and smooth sands of the South. The noblest in size, as well as most beautiful in color and features, are the algæ which are to be met with throughout this wide range. The would-be successful collector must resort to the dredging apparatus, and like the shell collector needs a strong arm and abundance of patient toil to serve him; else he must wait some violent storm, which shall break from their deeper moorings those more valuable weeds which only can grow perfectly and develop themselves entirely far below the surface, where the sun's rays but feebly penetrate and the water is of a nearly uniform temperature. Some wonderful waifs are occasionally met with in this way by visiting the beaches and picking over the waste with scrupulous care. In the warmer waters of the Southern States, like those on the Florida Keys, there may be sought singular kinds resembling corals, for which they were formerly mistaken by Lamouroux, some of exquisite beauty in design and shape. Some of these are found growing from the base of a *Gorgonia* or sea-fan, and secreting from the ocean their covering of lime. And others of richest green creep over the sand beneath the water, and throw up a turf as verdant as that which clothes

the most luxuriant pastures. This field of botanical enquiry is yet open, and many a desirable harvest can be reaped, from season to season, out of the treasures of the deep, and the yet undiscovered or little known species of New England attract the deserved attention of the casual visitor or of the sedulous student.

Let then the season be summer, the warm days of June, when many people as naturally resort to the seaside as if the custom were instinctive and migratory. To some the scenery is the same and familiar, and the cool air is the main thing to be realized; to others, though familiar yet ever new, and to others every object, however minute, is novel. The very rocks and cliffs are different in looks, composition and general features; the sand composed of curious minerals, tiny shells and comminuted fragments; the wild flowers wierd and unusual; the thick leaved and prickly seeded plants thriving within the spray's reach; the beach cumbered with productions of the sea—mineral, animal, vegetable—thrown in wild confusion. Who, for the first time, is not moved with wonder at these sea-weeds? Who would not wish to become better acquainted? And no wonder so many are gathered, floated out into shape, dried, pressed and carefully laid away, silent witnesses that beauty and utility are often combined where little dreamed of. The interest increases with each coming season; the practised eye soon learns to discriminate; the cultivated taste finds the most propitious time of the year for collecting, and such trifles, employed at first to while away an hour or two, are often found indispensable and auxiliary to the very enjoyment of life.

Suppose we start on a walk for some gravelly beach contiguous to some town or city, and removed from it by the interventions of wild pastures, rocky and almost desolate, or by some level, wide extended marsh. At any season of the year, when walking is practicable, the botanist who accompanies you, can point out abundant objects of interest long before you come within sea range. The intervening

space proves not so dreary or desolate as it appears, for often our most interesting and best friends have the rudest exterior. Perhaps he knows something about the lichens, those dull green, grayish, yellow, bright orange, black crusts, scales, fringes, torn, ragged felts; or perchance those dry, crisp, brittle, crimson tipped, blunt tipped, sharp pointed, branching anomalies which cover many an acre of sterility where nothing else grows, and where the surfaces of rocks and the rough bark of trees cannot offer them any chance. He will be able to introduce you through these desiccated and seemingly lifeless plants, the lineal descendants of the first forms of vegetation which appeared on the dry and solid earth, to the wonderful and more grotesque, more developed, sometimes enormous sea-weeds which, at the birth of Creation, sprung into activity as plants in the "waters which covered the face of the deep." Nay, you need not heed these unless you choose, although within every one of them lies enfolded a wondrous tale, locking up in the recesses of their natures, health and healing and joy. Notice too as you walk, the fair flowers springing up on every side. If autumn, or early winter, a bright October's day or a green Christmas, you may yet find for your admiration such seed-vessels, such starry calyces, such feathered down, such inimitable trifles as no gold could purchase or art fabricate.

Such rough and confused pasture lands lie between Rockport and the sea; between Gloucester, between Marblehead, Cohasset, Scituate and many famous places, and the beating ocean. By the very marge of one such beach I have found plants seen nowhere else by me except on mountain sides. Think of Rockport in July, lovely in the masses of mountain laurel, and this fine native shrub opening its clusters of flowers within sight of the very sea. From the land side the very odors of Araby the Blest come over the Manchester and Gloucester waters from the magnolia, and gladdens the heart of the returning fisherman. The very rocks, worn smooth by the surf and rounded and polished, extend

just so far inland, which the closely attached lichen defines by its persistence in bright yellow colors in the strict line of terrestrial and maritime growth. They stand there patient sentinels to denote that the floods shall no more cover the earth; the lichen the earth's plant, and the alga the sea's plant, approximate and almost kiss each other in approach. Nothing higher in the scale of organization ventures so near; not the sedge, bulrush or hardiest grass dare grow so close to the waves. Nor are lichen and alga far removed in consanguinity; in structural difference something; some more exposure to sun and rain, to snow and ice, to heat and cold, in existence and continued individual life vastly more in favor of the little crusted slow-growing lichen, patient, untiring, serenely beautiful, doing by day and night its usual work and breaking down the hardest and most obdurate rock formations by the gentlest persuasion of its constant presence to aid the atmospheric influences.

The algæ are so diverse in their forms, and so many in number, computing only the precise kinds or species, to say nothing of innumerable varieties, many of which have been separately and minutely described, that in order to facilitate the labor of finding out what they are it has been found best to divide them into three great groups known by the color of their seed-vessels. But as it is not always possible to find their seed-vessels, or even those minuter parts which though not seeds serve for similar purposes, because like other plants, and what we call flowers or flowering plants, these too have particular seasons of the year when they produce them, so to look for strawberries after the vines have done bearing would be precisely like looking for seed-vessels on sea-weeds when they had passed the season. Some kinds, too, like some other and higher plants never bear any seeds in our latitudes, but such seed bearing plants must be sought elsewhere. Fortunately in this dilemma the chances of success are in our favor, and the usual color of the sea-weed corresponds with the color of the seed it bears. The rosy or

red-seeded algæ are usually the most popular because the prettiest; but others, even the black or fuscous-seeded algæ have many claims on our attention. I will venture, however, to set both these kinds aside for awhile, and speak first of the green-seeded algæ, the *Chlorospermæ*, as they are called in the books.

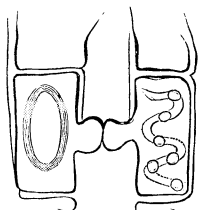
In the rear of some beaches, like that known to the old folks about Marblehead, as Devereux's beach, perhaps it has now another name, surely none more euphonious—may be seen large extended reaches of salt or brackish water, covered with floating masses of a light-green tangled fibre, and which lies in flakes upon the tips of the growing grass, or cast ashore to desiccate and fade in the bright sunshine. Lifting carefully a little on the end of a sharply-pointed stick we shall find a great many silky, glossy threads, each slender, sparingly branched with alternate and scattered branchlets somewhat spread apart; sometimes growing on one side, each joint several times longer than broad. Within each joint look after a green granular mass which answers for seeds, and to do this you must have a pocket lens for your eye; at home a compound microscope would do better, and in this rapidly growing and widely extending Chlorosperm you have taken your first lesson, perhaps, in studying the algæ, having been introduced to the *Conferva flavescens*, and if possessed with farther curiosity you may learn of other Confervas of equal or surpassing evidence. The extreme lightness which these sheets of dead fibres have, renders them easily elevated into the higher strata of the air, whence they have been known to fall in violent showers far into the interior, spreading consternation by their presence in such an unusual manner, and greatly frightening the superstitious and ignorant. Sometimes this substance has been called "meteoric paper," and I have seen in the microscopical cabinets of my acquaintances fragments of similar matter from very remote parts of the globe. This single species has been observed extensively in Europe and

America; and the few students of our native kinds have been rewarded by meeting with several others, identical with species which grew on the other side of the Atlantic Ocean, such as *C. bombycina*, *rivularis*, *aerea*, *refracta*, etc. But perhaps the most curious of these water silks, as they may be termed, credited to the northern lakes and to those lovely sheets of fresh-water in Central New York, is the *C. glomerata* of the earlier writers, but now called *Cladophora*, on account of the peculiar manner in which the joints arrange themselves, being either packed together in strata or layers, or flexed and curved in long and delicate lines; and another, far more curious, of which there are many sorts distributed from Sweden in the far north, to Cayenne in South America; found in Cuba, in New Zealand, in the lakes of Germany and in the fresh-waters of Great Britain; and worth looking after here, is the *C. ægagopila*, its filaments rolled together like a compact ball, and when dry, sometimes used for pen-wipers. I have looked for it, but always in vain; other delicate and pellucid-jointed water plants sometimes do so, but evidently they are only imitations. In the ditches and by the sides of shaded paths where the water is stagnant, similar *Chlorosperms* may be seen. Is there any identity and do the same algæ grow indifferently in fresh and salt water alike? The question is worth attention, so let us when we retrace our steps examine. Here I have lifted on the end of my cane some of these floating, swollen masses; they also are fibrous and silken, but see! how different is the green coloring particles within the joints! Here are a few in which the seeds are so arranged that the joints which are only about as long as they are broad, and vary in length, are marked by two roundish stars. It is but a rude idea produced by the arrangement of the seeds, but as these stand side by side in the parallel joints of two of the silken filaments of the tangle we have lifted from the ditch, and which are joined laterally by a connection or bridge, they remind us of the mythological story of Castor and



Pollux, the twins of Tyndarus, and our humble alga is accordingly called *Tyndaridea*, and of it are many kinds growing tangled even, in the same mass. In similar and

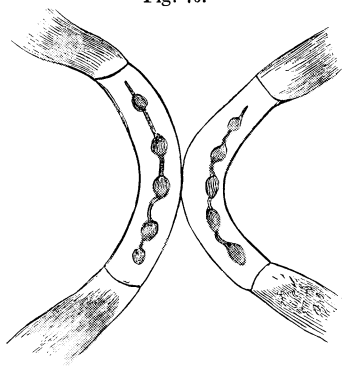
Fig 69.



Zygnema.

equally unlikely places for beauty to dwell and abide we can gather the *Zygnema*, or Yoke-thread, in the joints of which the green granules are at first arranged in spiral rings, but afterwards collect into a single globule as the future seed (fig. 69). In one species the spiral lines become a series of the Roman V, and in another of the letter X. Strangely, too, do the delicate and fragile filaments or silken threads bend at acute angles, the coloring matter first filling each joint, but soon contracting into a narrow continuous stripe. In this and others of similar behavior and appearance we have *Mougeotia* (fig. 70), named in memory of a botanist, and bearing his surname. They are common in Europe and New England. Before we leave these rich green, emerald and vivid, or pleasing green weeds of the stagnant and brackish pools, let

Fig. 70.

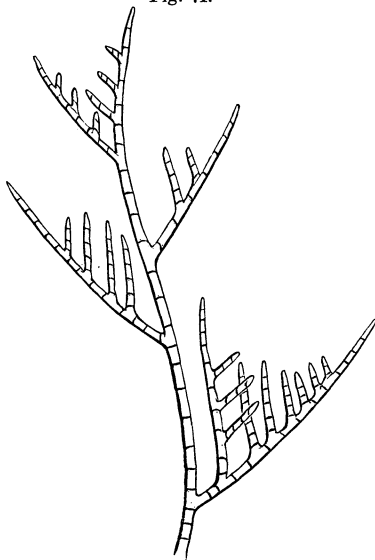


Mougeotia.

me tell you of a pleasant surprise I once had in the sunny waters of an overflowed and stagnant pool formed by the rising of the lake, and there permanent through the year for want of means of draining it. Years have fled and the pool is solid ground now, covered by the property of the railroad company, and near Burlington, Vermont. The conchologist may be pleased to learn that *Lymnæa megasoma* Say, once lived there; but my finding the elegant water-net, or *Hydrodictyon utriculatum*, previous to its being seen by the celebrated Bailey in Philadelphia and at West Point, will always

connect a delightful remembrance with stagnant pools and still waters in my mind. In this pretty aquatic the joints are united at their ends into regular pentagonal or hexagonal

Fig. 71.



Chaetomorpha.

meshes, and form a tubular net which floats in the water. Turning again towards the sea let us look into these salt pools among the cliffs, some shallow and others deep and lined with exquisitely colored algæ too. Certainly, so far as looks go, some of these verdant and glossy silks should be *Confervæ*, but having been instructed better by the lens let us see what it will do for us here. This flossy silk, how delicately and gracefully it floats just under the surface, but a little of it

lifted into the air collapses in a very ungrateful way. Yes! you have gone out of the realm of the *Confervæ* and only resemblances occur. Thus your floss silk, so entangling, inelegant in the air, shows its elegant proportions and finer divisions in its native elements and in water of a denser medium. It is a tuft of a true maritime *Chlorosperm* (fig. 71), one of a very large genus, and as Professor Harvey tells us, difficult to define; so we must be content with our present knowledge to observe and admire. Some tufts of darker green colored and bristle-like jointed filaments stand stiffly in the water; they are worth gathering, and bear the name of *Chaetomorpha*, or Bristle alga; the most common with us is the *Melagonium*, but several others may be found on the New England shores and the Mediterranean, the Canary Isles, Algiers, New Holland, Tropical America and the East

Indies ; the northern and southern portions of the globe delight in their presence. For specimens they only dry indifferently, the joints shrinking by dryness, but the algologist cares little for looks. Very marvels are those closely adherent algæ, which creep over moistened surfaces, and some of which are found on rocks wetted by the sea, many in springs of flowing water, some in hot springs, and such unlikely places ; but I should scarcely forgive myself if I overlooked in this connection the *Microleus repens* (fig. 72), in masses resembling a green slime of almost black intensity ; but lifted from the wet path and a few of its conferva-like threads magnified, shows its claim to regard. As the little bit expands under water the microscope assists you to see the oscillating motions of its jointed filaments, creeping apart from each other like the measured progress of the hand over the dial plate of your watch !

Fig. 72.

*Microleus repens.*

Similar, but not tied up in little sheathing bundles, are the pretty *Lyngbyas*, snarls of silky fibres, but each in a mucous sheath by itself and divided into numerous transverse joints of rich deep green, purple, brown and other colors ; widely diffused over the globe and extensively scattered over wet surfaces, faces of rocks, and places where we should expect nothing curious or striking. They too, boast of many kinds of residence in the sea, in salt marshes, among pebbles on the shore, in hot springs, and the water of salt works, living alike in fresh or saline homes.

Some few larger and more specious Chlorosperms are those rich green crisped and wavy-margined thin algæ, which lie upon the soft mud after retreating tides, covering unsightliness with continuous beauty, and refreshing the eyes. They are known as "lavers," *Ulvæ*, and two or three species are well known. They do not make very pretty specimens, but pieces of them can be advantageously employed in arranging

other kinds. Sometimes they are served up with lemon juice under the name of Oystergreen, and as a diet are considered of good repute. The broadest leafed kind are selected. The green particles which correspond to the seeds are deeply embedded in the pulp of the entire plant, and commonly arranged in fours, while those of the Purple laver (*Porphyra*), which notwithstanding their color, so distinct from the seeds of the Chlorosperms, form an exception to the general rule, and though possessing rounded granules, quaternally arranged, are also provided with clusters of oval

Fig. 73.

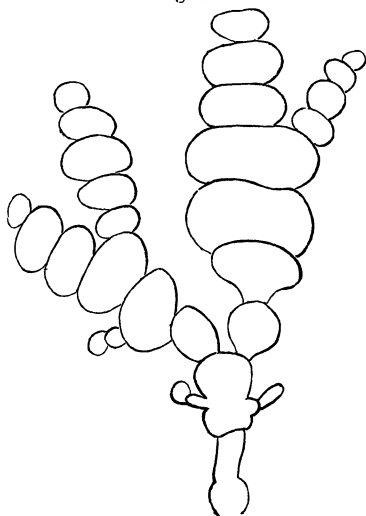
Seeds of *Porphyra*.

seeds (fig. 73) besides thus indicating a step forward in the progressive development. To find this pretty alga it is well to examine the piles and timbers of wharves, and the perpendicular faces of rocks submerged by the tides. Other and finer species than our own have a wide dispersion, and in common with the green lavers may be frequently met with, abroad, in similar situations. Not very unlike their cousins, the *Ulvæ*, are the grotesque looking, pale green, inflated bullate *Enteromorphas*, tossed in wild confusion, and mingled irrespectively together, with the usual rejectamenta of the sea upon the rocks; despised and overlooked as they are apt to be there they are respectable Chlorosperms when growing and thriving under the water; and a little care and attention to their merits will give them their place among the dried trophies of the ocean gleanings. Singularly alike, and yet different, are the *Tetrasporas* of the fresh-water, floating quietly upon the stream, their lax netted tissues of pleasant green color having their interior substance dotted over with clusters of seeds arranged in fours; and others of humbler pretensions but of wondrous symmetry and beauty nestling like small disks upon the pebble or upon the submerged log, or throwing wide upon the current their elegant beaded filaments like necklaces of strung jewels, embraced by the Chlorosperms or claimed by aberrant forms of the *Confervæ*.

Some tropical sea-weeds belonging to this section now claim the attention. These are the Siphonaceæ, so-called because whatever be the form or size of the alga the different parts have a continuous cavity throughout like a pipe or siphon. And a very great difference exists in these several forms, some of which are very singular, others very beautiful. They are described as green, marine or fresh-water algæ, either naked or else coated with carbonate of lime, which they extract by the method of their growth and life from the water. A few kinds, of which the elegant *Bryopsis* is an instance, are found in our northern bays and waters. It is a pretty little green-tufted feather-like alga, parasitic on other weeds, and growing on the rocks near the shores. Yet in its range it reaches to Cape Horn, the Falkland Islands and New Zealand. The green particles within its substance break up into smaller parts, and bursting through the sides of the branches escape to furnish the needed seed dispersion. In a somewhat similar branching kind, but in which the single jointed filaments and branchlets or twigs, as we may call them, are compacted together into flattened bundles, so as to look like a rude fan furnished with a handle or stem, and the sticks somewhat encrusted with carbonate of lime, we have the *Udotea*, named by Lamouroux after some ocean goddess, known to Hesiod. One species, the *U. conglutinata*, of Lamouroux, has been seen growing at Key West; and another, in which the lime is uniformly and evenly deposited on the entire surface, much more resembles a spread-out fan, and is known in our tropical seas as *U. flabellata*, while other seas produce still other forms. They are so bizarre and unlike ordinary algæ that no one but an adept would recognize their place among sea-weeds. In *Halimeda* (fig. 74) we have still other singular and anomalous looking plants, short-jointed and broadly dilated for the length of the joints, looking not unlike some smaller truncated cactus of the green-house, but soon fading to a dull white tint, and on drying becoming brittle. Several species are met with

on the Florida shores, of which, perhaps the *H. opuntia* is the most common, as I have picked several fragments of its clustered stems from gorgonias and corals collected among the Keys. Removing the lime encrustations, a singular skeleton of fibres, branching off into clusters of smaller branches, presents itself and which serves as a support to the tissues. In company with these oddities is another singular marine production, composed of innumerable slender, single-celled

Fig. 74.



Halimeda.

branching filaments, inextricably woven together into the form of a hollow ball, and which grows from the size of a cherry to that of the human head, and is known in the European seas as *Codium bursa*, or Sea-purse; while another species with a narrow, long, branching form, but with fibres similarly entangled and woven, has been found on the coasts of California, but is not known on the Atlantic shores of New England, a prize perhaps for some sea-weed collector! Of

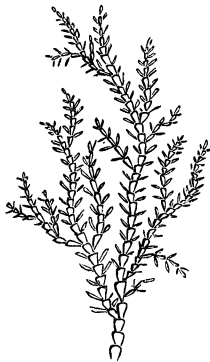
the other siphon-constructed algæ may be cited the *Caulerpas*, elegant, green, creeping-rooted algæ, mimicking under graceful forms, the ferns, club-mosses, feathery mosses, ground pines, selaginæ and other higher cryptogamic plants, such as grow in the woods and in bogs remote from the sea; investing the submarine sands and tide-washed rocks with perennial verdure and loveliness, and found alike in every tropical sea on the globe.

These lime-bearing algæ so far away from our personal observation, and to be seen only in our most southern latitudes, should have some representatives on our northern

shores, and it is to the Corallines and their allies that we will turn for farther enquiry. Leaving, however, unwillingly, the attractive Chlorosperms we will make some acquaintance with the beautiful family of the Rhodosperms, or rosy-seeded algæ, plants corresponding in the tints and colors of their external and internal arrangements, with the elegance of their seed-vessels and seeds. In outward habit the Corallines present also considerable variety from the simplest and lowest in the mode of increase similar to that of the crustaceous lichens, spreading in horizontal concentric circles, or gradually developing upwards and outwards in the form of stems and branches. On every part, encrusted in their lime covering which moulds itself to the joints, swellings, depressions, ridges, or into the flutings and channels of the surface, or surmounts the very tips in the form of seed-vessels, one would scarcely suppose that these elegant marine productions — so abundant in every tide pool, and fringing the deep cool grottos beneath the water-covered rocks, or lining with patches of pleasing and varied colors their sides, or laying down tessellated and mosaic pavements, by encrusted pebbles presenting to the vision variety springing from their secreted cements — were sea-weeds and marine vegetation. But an immersion in diluted mineral acids dispels the mystery; the usual tender and flaccid tissue of cells and pulp appear in due proportions beneath the covering which looks so much like the fabrications of the polyps, and in the absence of microscopical investigation these innocent plants were described and figured as animals related to the corals, and from their smaller size and comparative insignificance were called Corallines. Very rarely found in the colder seas the one species best known at the north is the *Corallina officinalis* (fig. 75), once in fictitious repute in medicine. You cannot miss it, growing as it does in the pools left by the tides, and to be picked from the beaches attached to some shell, most usually the larger muscle (*M. modiolus*), thus indicating its range even in

deeper soundings where that mollusk abounds. A much more slender and delicately jointed kind, scarcely more than simply branching, is the *Jania*, presenting under the surface of the ocean a violet green tint, which soon changes to a more or less deep rosy or red, and finally becoming shining white if exposed to the air and light, growing parasitically on other sea-weeds and widely distributed. Some elegant species are known in Cuba and on the southern coast of the

Fig. 75.



Coralline.

United States, and others are found in the oceans about Australasia, Cape of Good Hope, etc. The *Amphiroæ*, also widely distributed over the globe, are lime-bearing Corallines, the joints cylindrical, separated from each other by bare portions of the horny axis, the seeds lodged like those of all the Corallines in conical wart-like conceptacles, the different parts of the little plant on which these occur furnishing some criterion to determine its real name. Beautiful and interesting as they seem in living condi-

tion, a more intimate examination assists in revealing their curious structures. Having in this excursion for northern lime-encrusted sea-weeds stepped into the domains of the Rhodosperms, or rosy-seeded algæ, let us take leave of our verdant acquaintances, and cultivate the friendship of a higher series of marine plants, whose seeds and seed-vessels are more curious, elegant and diverse.

The algæ in this order are by far the most universally attractive of any of our native kinds. That part which looks like their foliage, and is technically called the *frond*, is liable to a great difference in size, shape, and outline, in some being broad, or flat, or narrow, or thread-like, the main stem frequently dividing, or the disk-like support on which it rests suddenly spreading and ramifying upwards, the branches often arranged in regular pinnæ, or lateral wings,



and these again dividing into smaller branchlets; or the broad, thin, membranous leaf throwing out similar but smaller ones from its edges; the seed-vessels often displaying much beauty and elegance of design, and variously distributed in the leaves; add, too, that gathered at almost any season, they make pretty specimens for the album, either as portions of the plant or even as fragments, it were no wonder that equally with the child and the adult the Rhodosperrms become favorites, and are considered foremost among the wonders of the sea.

Attracted by the brilliant crimson feathery bit which now comes riding on the crest of the wave, the attempt to secure it as a prize is successful. It came from deep soundings, and has been torn off from the friendly support of some gigantic kelp, by a sudden swell or rude wind. Thousands of just such bits, and some of them several inches long and broad, you can pick out of that drift high up on the beach. It is the *Ptilota serrata*, and though so common here, should you chance to gather algæ on the coast of California you will find it there, the denizen of the Atlantic and Pacific alike, while those who collect for amusement from the beaches of Rhode Island, New York, New Jersey, etc., may find another, *P. elegans*, likewise found at Beverly and its neighborhood, a smaller and softer plant with jointed pinules. On the tips of the main branches, and enclosed by the curving of the smaller, are lodged the pretty conceptacles or seed caskets, giving the plants a feature of interest. The species of *Ptilota* are not numerous, but they are found in most parts of the world. A still more beautiful fragment is this which I have at this moment rescued; I find it frequently with the last but seldom can I find a perfect piece, such as is now lying on my study table at home, from the English coast. In outline and ramification a little like *Ptilota*, but its dichotomous branches are two-edged with a sort of thickened midrib, its color a dark lake, and it dries into good shape. It has two kinds of seeds, some growing

in the pulp of the frond in clusters (*tetraspores*), the others issuing from conceptacles which grow on the outside of the smaller branches. On the French coast it is called *P. vulgare*, or the Common Ptilota, and Kützing says that it occurs in the Atlantic, Pacific, and Southern Oceans.

The Carrigeen moss, so well known in the preparation of food, and to many more familiar on the table than on the shores of the ocean, is the *Chondrus crispus*, really an elegant alga. It is subject to many varieties, and the best way to study them is to go down as far as you can among the rocks at low tides and see the plant growing. A careful drying of some of the most prominent sorts will repay. Those gathered from the beaches are more or less bleached or discolored, and generally filled with sand. In similar situations, and even growing where the water is always deep, some other algæ similar yet distinct may be sought. Like others which grow out of reach except by the dredge, they are thrown ashore in tolerable perfection during storms. Of these the *Phyllophora membranifolia* may be cited, the fronds as much as a foot long when fully grown, the stem cylindrical, filiform, irregularly branched, the branches expanding into fan-shaped flattened membranous leaflets, the color a rich purple, inclining to livid, while that of the European species is scarlet. The *Gymnogongrus* which inhabits similar situations might be mistaken for the *Chondrus*, looking not unlike some variety of it, but its internal structure forbids this. Something like twenty kinds are known in the world, and the one most seen in this neighborhood is *G. Norvegicus*, having an extensive northern distribution.

These black tufts growing out of the stems of the larger algæ, and from the outside of shells, etc., belong to *Poly-siphonia nigrescens*, of which the curious student could find a great many distinct varieties. A section of the frond would exhibit a number of tubes, side by side, composing the branch, and indeed the entire plant, and those tubes vary in

number, and yet seemingly not in a capricious manner, in different tufts. Though thus inelegant and vulgar or common, they belong to a refined and delicately educated family, having in their circle some of the prettiest algæ known in the American seas, of which the Venus' Comb (*P. pecten-Veneris*) found parasitic on corals and shells at Key West and the Pine Islands, is a notable example; and indeed all require only to be magnified to show what they are. There are numerous species to be looked up on the various sea-weeds and marine objects on which they delight to grow. This almost gelatinous mass of dissolving threads staining the paper with a deep empurpled or crimsoned blotch, is the *Dasya elegans*, more commonly met with to the south of Cape Cod; it is likewise a parasitic alga and grows in deep water; nor are other beautiful species unknown in distant regions. *Rhodomela* is worth looking for, being an elegant, much branched, filiform, cylindrical-stemmed alga, of which *R. subfusca*, *gracilis*, *Rochei*, etc., have been collected on the coast of Massachusetts. The several species belong to temperate zones. In the English manuals much is said of the beauty of the *Lawrencea*; in this country this alga is represented by the *Chondriopsis* of J. Agardh, and some may be sought, of which *C. Baileyana* is really elegant and graceful, while its conceptacle, or seed-vessel, is of classic outline, minute, yet not to be overlooked! Others similar might be alluded to, but we must defer mention of them, unless we meet them in their coral groves in waters of a higher temperature.

The broad-fronded rosy sea-weeds claim a passing tribute. Our beaches and shores, the resort of summer seekers for pleasure and profit, offer us the *Delesseria* with a genuine rosy-red, leaf-like, jagged edged, or else delicately branching membranous symmetrical frond, with a percurrent midrib. The seed-vessels are to be looked for near the midrib, but definite spots containing another sort of seeds occupy the surface or portions of the frond besides. Several species are found both north and south, but by far the finest is the *D.*

*Americana*, dedicated to Henry Grinnell of New York, in honor of his noble conduct in an expedition fitted out by him in search of Sir John Franklin, and known to American botanists as the *Grinellia* of Professor Harvey. In *Nitophyllum* we have a ribless frond, traversed by slender irregular veins; the frond broad membranous and variously divided, the seeds in the form of dots deep in the pulp of the leaf. *Calliblepharis ciliata* has the margins of its rich dark red frond beautifully ciliated or fringed; *Botryoglossum* and *Hymenena* are California species and can scarcely be looked for with any degree of success hereabouts. The *Rhodomeniæ*, with *Euthora*, are plants of great beauty, and need scarcely more than be named as the species are few; *R. palmata* is parasitic on algæ in shallow water; *R. palmetta* on the larger kinds in deeper soundings, and *E. cristata* extends in its range from the Arctic coast to Cape Cod.

Among the most abundant of these rosy-seeded algæ, and likewise of the most delicate structure, we notice the *Ceramiaceæ*, with fronds growing in close tufts, but sometimes solitary, creeping along the surface by fibres or affixed by disks, the stems slender, thread-like, articulated, dichotomously or pinnately branched, and sometimes growing so interwoven as to form network or spongy masses. In some species the space between the joints is diaphanous, which gives a strikingly beautiful appearance; in others the joints exhibit no such peculiarity. The species are exceedingly numerous, and the search for rarer ones in any given district would be compensating to him who does not despise trifles such as these at first seem.

The last of the Rhodosperms to which we invite your attention is *Callithamnion*, a very large genus of beautiful algæ, mostly small and many even minute, the different species difficult of determination, subject as they are to constant variation. The elegance of their several parts in stem, branches, and branchlets, the delicacy of their subdivisions, their exquisite color and the symmetry of the seed-vessels

in spite of the obstacles in correctly addressing them by their correct names, attract the attention of the most superficial. They are not difficult to find, and the same efforts to secure other and more specious kinds will insure many of these.

The Melanosperms, black or fuscous seeded sea-weeds, less comely and attractive but by far more useful to savage and civilized man alike, remain for a cursory glance at least. Although our species are of only a respectable size when compared with foreign kinds, yet they assist so much in producing the effect we witness, wherever the ocean impinges on the land, we can illy spare them. Investing rock and wood structures alike, if built in places subject to the variations of the tides, they bear exposure of a few hours to the dry atmosphere or scorching sunshine, and revive as the cooled waters return to cover them, forming safe retreats to fishes, mollusks and other marine creatures, and affording the most nutritious dressings by way of manure to the exhausted fields. The variety of forms which they present has caused them to be comprised in several families with subdivisions arranged in such a way that they can be more readily studied, and those will claim our notice. About our shores the most abundant sea-weed of this kind is the *fucus*, of which there are two or three species and several varieties; or according to Professor Harvey five species on the American and seven species on the European shores, and one allied to *F. nodosus*, found at the Cape of Good Hope. They are usually known as kelp weed, rock weed, etc. Their seeds are lodged in tubercles filled with mucus, and they are discharged through the small pores; the hollow vesicles by which they are buoyed up in the water are not the seed-vessels but air bladders. A section of one of these seed tubercles, under the microscope, affords an instructive and pleasing sight. The *Hulidrys siliquosa* might be readily taken for a narrow fronded fucus, but the air vessels are singularly divided transversely by numerous diaphragms extremely thin and

membranous. It is usually found in shallow pools, but where the plant is never left to even temporarily become dry. Though very common on the Atlantic shores of Europe it does not seem to have been recognized here as growing on this side of the ocean. The *Cystoseira*, too, is only recognized as American in a California species though several are known to the British waters, and the *Phyllospora Menziesii*, detected by Menzies himself when with Vancouver, has elsewhere as yet only occurred in the deeper soundings of the California coast. In this plant we see the same globular air vessels we have noticed in the fuci. To this family belong also the gulf weeds, *Sargassum*, a vast genus and of which some species extend as near as Nantucket and Providence. One of them, the tropical Sea-grape (*S. bacciferum*), is seen floating in masses in the gulf stream, and is a familiar object. Kützing gives us a list of one hundred and three distinct species known over the globe!

An excessively branched and bushy mass of dark brown fibres, covered with short harmless prickles, and sometimes growing several feet in length, often presents itself on the sandy beaches, evidently torn from the bottom of deep water. This is *Desmarestia aculeata*, so variable in appearance at different stages of growth as to have led good botanists astray. When young, this otherwise stiff, bristly weed is clothed with the most delicate pencils of finely divided filaments, of a beautiful green color, a condition worth seeking. Its mode of bearing seeds is unknown.

Another natural order of the Melanosperms, comprising a great variety of kinds, is the *Laminariaceæ*, among which—from a simple cylindrical threadlike frond of the diameter of a whip-cord, and often twenty, thirty or forty feet in length, tapering at the extremity, and fixed at the base by a disk (*Chorda filum*) to a frond of broad dimensions, and supported by a long stalk (*Laminaria* or oar-weed)—we find a series of modified forms in species found in our waters. Of the sea leaf (*Thallasiophyllum*), one of this order, a writer

and naturalist thus speaks : "The ocean hardly boasts of a more beautiful production ; it is generally about the height of a man, very bushy and branched, each branch bearing a broad leaf at its extremity, which unfolds spirally ; a spiral border winds round the stem ; a number of rather long, narrow perforations, arranged in a radiate form, give the frond the appearance of a cut fan ; the margin is entire, its substance coriaceous, but liable to be torn. No seeds have been detected. This fine fucus, or sea-weed, is plentiful around the whole island of Amaknak, clothing the rocky shore like a thick hedge, and forming at a little distance a very pleasing feature in the scenery." (Mertens as quoted by Professor Harvey.) Though destitute of this wondrous sea-leaf, our piles of seawrack can display something similar in the highly curious sea colander (*Agarum Turneri*), which has come ashore after strong winds and gales. Furnished with a short, compressed, coriaceous stem, widening and flattening as it approaches the frond, and clasping by its stout fibrous roots the rocks and stones, its dark olive green expanded leaf perforated at short intervals with roundish holes, it is quite a respectable weed. The shores of Kamtschatka and the Pacific recognize others. Besides several kinds of the oar-weed of respectable dimensions, such as the Sweet or Sugar, the Long-shanked, the Fingered, with its frond deeply cleft into several strap-shaped segments, we have for noble sea-weeds *Alaria esculenta*, known, as articles of food, under the name of mur-lins among the peasantry of Scotland and Ireland, belongs to a small genus, inhabits the colder regions, and is recognizable by a branching root, stalked, membranous frond, with smaller fronds or leaflets springing from the stalk and below the main frond. A definite dark colored patch in the centre of these leaflets indicates the clusters of pear-shaped seed-vessels packed vertically among straight and simple threads.

From these we come by easy transitions to some of the most marvellous vegetable productions on our globe, and

algæ, or sea-weeds, too. How insignificant appear our kelp-weeds in comparison with the *Lessonia* of the Antarctic Zone, trees with forking and branching trunks covered with crimson brown, sinuated edged, and jagged-toothed leaves, or with blackish opaque foliage and twisted flexuous trunks, growing like submarine forests; or with the *Nereocystis* of the Aleutian islands, whose stem, never thicker than a packthread, extends to the length of forty fathoms or more, and expands at the summit into an inflated cylinder from which issues a leaf, which gradually grows wider near its top; not singly, not here and there a plant but areas of great extent covered with innumerable plants; or with the *Macrocystis* whose slender stem and numerous leaves are buoyed up by their expanded and swollen base, the stem so long that fifteen hundred feet has been reported by observers as within the limits of belief. These several kinds of expanded fronds are employed as utensils among savage people, while the trunks of many of these gigantic algæ drifting on desert shores have been mistaken and gathered for fuel, supposed to be actual wood.

The structural arrangement of the cellular tissue on a number of the Melanosperms, giving to their fronds a peculiarly netted appearance when viewed through a magnifying glass, suggests a natural order, called *Dictyotidæ*, which signifies like a net. Externally there is quite a variety among these sea-weeds, and of them we may search for *Punctaria* in two species, both parasitic on other and larger sea-weeds about Boston Harbor, or even *Asperococcus* with an inflated frond, while the others delight in a flattened one. The seeds may be found in the minute dot-like clusters scattered over the surface of the plants. To this order belong the curious *Padina pavonia* and its allied *Zonaria lobata*, bearing no inapt resemblance to those richly zoned and velvety fungi which grow out of old dead tree-trunks; but both these lovely algæ are tropical and belong to our most southern states. The rest of the Melanosperms are either parasitic and minute, and to be gathered either accidentally or else



though strange and unusual in exterior, so infrequently that they hardly claim our present attention. In the structure of their seed-vessels and seeds they are objects of curious interest and beauty, but require a quick eye to detect the condition favorable to secure specimens, which when collected, must be submitted to the microscope to satisfy the enquirer.

If our excursion and lesson has convinced us that in the distribution of plants, the ocean, which to many, shuts out the chance of minute observation, forms no exception to the law of vegetation; each part of its vast bosom bearing, like the earth, its appropriate flowers, plants and fruits, a day or two among the sea-weeds will be well employed.



## FOOT-NOTES FROM A PAGE OF SAND.

BY DR. ELLIOTT COUES, U. S. A.



IF those whom fashion and the weather drive from city follies and vices to the vices and follies of the seaside; who live in hotels and carriages and fancy the society of their kind the only sort desirable or possible,—if such read at all by the sea shore, it is not from the broadest and most eloquent page before them. With eyes to see, blind; deaf, with ears to hear; to them, a blank, a void, beyond the titillation of social scandal. Others go out of doors afoot, looking and listening; in every object by their pathway a familiar thing; with every vibration of the air, a well known voice; with every odour a reminiscence. *Alone* by the sea? There is no solitude—no escape for the naturalist, even though in a weak moment he wish it, from a multitude—no disentangling of self from the web of animate creatures of which he is one slender thread.

The sea, we know, is teeming with life—full of shapes